

UNIT TERMINAL OBJECTIVE

COGNITIVE OBJECTIVES

8-4.1 Explain the role of the paramedic/ EMS responder in terms of the following: (C-1)

- 8-4.2 Size-up a hazardous materials (haz-mat) incident and determine the following: (C-1)

- 8-4.3 Identify resources for substance identification, decontamination and treatment information including the following: (C-1)

- 8-4.4 Explain the following terms/ concepts: (C-1)

- 8-4.5 List and describe the following routes of exposure: (C-1)

- 8-4.6 Explain the following toxicologic principles: (C-1)

- 8-4.7 Explain how the substance and route of contamination alters triage and decontamination methods. (C-1)

8-4.8 Explain the limitations of field decontamination procedures. (C-1)

8-4.9 Explain the use and limitations of personal protective equipment (PPE) in hazardous material situations. (C-1)

8-4.10 List and explain the common signs, symptoms and treatment for the following substances: (C-1)

- Corrosives (acids/ alkalis)
- Pulmonary irritants (ammonia/ chlorine)
- Pesticides (carbamates/ organophosphates)
- Chemical asphyxiants (cyanide/ carbon monoxide)

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- e. Hydrocarbon solvents (xylene, methylene chloride)
- 8-4.11 Explain the potential risk associated with invasive procedures performed on contaminated patients. (C-1)
- 8-4.12 Given a contaminated patient determine the level of decontamination necessary and : (C-1)
 - a. Level of rescuer PPE
 - b. Decontamination methods
 - c. Treatment
 - d. Transportation and patient isolation techniques
- 8-4.13 Identify local facilities and resources capable of treating patients exposed to hazardous materials. (C-1)
- 8-4.14 Determine the hazards present to the patient and paramedic given an incident involving hazardous materials. (C-2)
- 8-4.15 Define the following and explain their importance to the risk assessment process: (C-1)
 - a. Boiling point
 - b. Flammable/ explosive limits
 - c. Flash point
 - d. Ignition temperature
 - e. Specific gravity
 - f. Vapor density
 - g. Vapor pressure
 - h. Water solubility
 - i. Alpha radiation
 - j. Beta radiation
 - k. Gamma radiation
- 8-4.16 Define the toxicologic terms and their use in the risk assessment process: (C-1)
 - a. Threshold limit value (TLV)
 - b. Lethal concentration and doses (LD)
 - c. Parts per million/ billion (ppm/ ppb)
 - d. Immediately dangerous to life and health (IDLH)
 - e. Permissible exposure limit (PEL)
 - f. Short term exposure limit (TLV-STEL)
 - g. Ceiling level (TLV-C)
- 8-4.17 Given a specific hazardous material be able to do the following: (C-1)
 - a. Research the appropriate information about it's physical and chemical characteristics and hazards
 - b. Suggest the appropriate medical response
 - c. Determine risk of secondary contamination
- 8-4.18 Determine the factors which determine where and when to treat a patient to include: (C-1)
 - a. Substance toxicity
 - b. Patient condition
 - c. Availability of decontamination
- 8-4.19 Determine the appropriate level of PPE to include: (C-1)
 - a. Types, application, use and limitations
 - b. Use of chemical compatibility chart
- 8-4.20 Explain decontamination procedures when functioning in the following modes: (C-1)
 - a. Critical patient rapid two step decontamination process
 - b. Non-critical patient eight step decontamination process
- 8-4.21 Explain specific decontamination procedures. (C-1)
- 8-4.22 Explain the four most common decontamination solutions used to include: (C-1)
 - a. Water
 - b. Water and tincture of green soap
 - c. Isopropyl alcohol
 - d. Vegetable oil

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8-4.23 Identify the areas of the body difficult to decontaminate to include: (C-1)

- a. Scalp/ hair
- b. Ears/ ear canals/ nostrils
- c. Axilla
- d. Finger nails
- e. Navel
- f. Groin/ buttocks/ genitalia
- g. Behind knees
- h. Between toes. toe nails

- 8-4.24 Explain the medical monitoring procedures of hazardous material team members to be used both pre and post entry, to include: (C-1)

- Vital signs
- Body weight
- General health
- Neurologic status
- ECG

- 8-4.25 Explain the factors which influence the heat stress of hazardous material team personnel to include: (C-1)

- Hydration
- Physical fitness
- Ambient temperature
- Activity
- Level of PPE
- Duration of activity

- 8-4.26 Explain the documentation necessary for Haz-Mat medical monitoring and rehabilitation operations. (C-1)

- The substance
- The toxicity and danger of secondary contamination
- Appropriate PPE and suit breakthrough time
- Appropriate level of decontamination
- Appropriate antidote and medical treatment
- Transportation method

- 8-4.27 Given a simulated hazardous substance, use reference material to determine the appropriate actions. (C-3)

- 8-4.28 Integrate the principles and practices of hazardous materials response in an effective manner to prevent and limit contamination, morbidity, and mortality

None identified for this unit.

At the completion of this unit, the paramedic student will be able to:

- 8-4.29 Demonstrate the donning and doffing of appropriate PPE. (P-1)
8-4.30 Set up and demonstrate an emergency two step decontamination process. (P-1)
8-4.31 Set up and demonstrate an eight step decontamination process. (P-1)

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- e. Tractor-trailers
2. Transportation
 - a. Railroads
 - b. Pipelines
3. Storage
 - a. Tanks/ storage vessels
 - b. Warehouses
 - c. Hardware/ agricultural stores
 - d. Agriculture
4. Manufacturing operations
 - a. Chemical plants
 - b. All manufacturing operations
5. Terrorism
 - a. Workplace
 - b. Shopping
 - c. Other public environments
- B. Recognition of hazard
 1. Placarding of vehicles
 - a. Required by law
 - b. Some vehicles not placarded
 - c. Placarding in emergency response guide
 2. UN/ DOT placard classifications
 - a. Explosives
 - b. Gasses
 - c. Flammable liquids
 - d. Flammable solids
 - e. Oxidizers and organic peroxides
 - f. Poisonous and etiologic agents
 - g. Radioactive materials
 - h. Corrosives
 - i. Miscellaneous hazardous materials
 3. Recognition of UN numbers
 4. NFPA 704 System for fixed facilities
 - a. Blue = health hazard
 - b. Red = fire hazard
 - c. Yellow = reactivity hazard
- C. Identification of substances
 1. The "crux" of dealing with a hazardous material
 2. Often difficult-especially with unknown substances
 3. Material safety data sheets (MSDS)
 - a. Detailed substance information
 4. Shipping papers
 - a. Substance ID
 5. DOT Emergency Response Guide
 - a. UN numbers
 - b. Names of substances
 - c. Emergency action guide
 - d. Placard facsimiles
 - e. Evacuation/ isolation information
 6. Poison control centers

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- a. Detailed toxicology information
 - b. Decontamination methods
 - c. Treatment
7. CAMEO computer database
 - a. Information
 - b. Computer modeling
8. CHEMTREC
 - a. 24 hour toll free hotline
 - b. Product and emergency action information
9. Other reference sources
 - a. Textbooks
 - b. Handbooks
 - c. Technical specialists
10. Monitors and testing for unknown materials
 - a. Air monitoring equipment
 - b. Gas monitoring equipment
 - c. Ph testing
 - d. Chemical testing
 - e. Colormetric tube testing

1. Hot zone
 - a. Contamination actually present
 - b. Site of incident
 - c. Entry with high level PPE
 - d. Entry limited
2. Warm zone
 - a. Buffer zone outside of hot zone
 - b. Where decontamination corridor is located
 - c. Corridor has "hot" and "cold" end
3. Cold zone
 - a. Safe area
 - b. Staging for personnel and equipment
 - c. Where medical monitoring occurs
 - d. One end of corridor

1. Boiling point
2. Flammable/ explosive limits
3. Flash point
4. Ignition temperature
5. Specific gravity
6. Vapor density
7. Vapor pressure
8. Water solubility
9. Alpha radiation
10. Beta radiation
11. Gamma radiation

1. Threshold limit value (TLV)
2. Lethal concentration and doses (LD)
3. Parts per million/ billion (ppm/ ppb)

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4. Immediately dangerous to life and health (IDLH)
5. Permissible exposure limit (PEL)
6. Short term exposure limit (TLV-STEL)
7. Ceiling level (TLV-C)

A. Types of contamination

1. Primary contamination
 - a. Exposure to substance
 - b. Only harmful to individual
 - c. Little chance of exposure to others
2. Secondary contamination
 - a. Exposure to substance
 - b. Substance easily transferred
 - c. Touching patient results in contamination
 - d. Key concept in hazardous materials medical operations
 - e. Gas exposure rarely results in secondary contamination
 - f. Liquid and particulate matter more likely to result in secondary contamination

1. Topical absorption

1. Topical absorption
 - a. Skin and mucous membranes
 - b. Not all skin absorbs at same rate
 - c. Not all poisons easily absorbed
2. Respiratory inhalation
 - a. Absorption through bronchial tree
 - b. Oxygen deficient atmospheres
3. Gastrointestinal ingestion
 - a. Ingestion of substances
 - b. Factors affecting absorption
4. Parenteral injection
 - a. Injection
 - b. Wound entry
 - c. Invasive medical procedures

1. Absorption

1. Absorption
 - a. Time to delivery into blood stream
2. Distribution
 - a. Distribution to target organs
 - b. Poison or drug binds to tissues/ molecules
 - c. Actions
 - d. Deposits
3. Biotransformation
 - a. Liver
4. Elimination
 - a. GI
 - b. Kidney
 - c. Respiratory

1. Acute toxicity

- a. Immediate effect from substance

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2. Delayed toxicity
 - a. No immediate effect
 - b. Symptoms later appear
 - c. Delayed pathology or disease
3. Local effects
 - a. Effect immediate site
 - b. Burn model
 - c. Progression of effects like burn
 - d. Topical or respiratory
 - e. Skin irritation - acute bronchospasm
4. Systemic effects
 - a. Cardiovascular
 - b. Neurologic
 - c. Hepatic
 - d. Renal
5. Dose response
 - a. Physiologic response to dosage
 - b. How much to get an effect
 - c. Essential concept for decontamination
6. Synergistic effects
 - a. Combinations may react synergistically
 - b. Standard pharmacologic approach
 - c. Standard treatment can result in synergy
 - d. Medical control/ poison control reference
- E. Treatment for commonly encountered hazardous materials
 1. Corrosives (acids/ alkalis)
 - a. Typical exposures
 - b. Actions
 - c. Decontamination methods
 - d. Treatment
 - e. Transportation precautions
 2. Pulmonary irritants (ammonia/ chlorine)
 - a. Typical exposures
 - b. Actions
 - c. Decontamination methods
 - d. Treatment
 - e. Transportation precautions
 3. Pesticides (carbamates/ organophosphates)
 - a. Typical exposures
 - b. Actions
 - c. Decontamination methods
 - d. Treatment
 - e. Transportation precautions
 4. Chemical asphyxiants (cyanide/ CO)
 - a. Typical exposures
 - b. Actions
 - c. Decontamination methods
 - d. Treatment
 - e. Transportation precautions
 5. Hydrocarbon solvents (xylene/ methylene chloride)

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- (3) Need for rapid EMS PPE
 - (4) Need quick transport isolation methods
 2. "Fast break" incident decision making
 - a. Critical patient - unknown/ life-threatening material
 - (1) Decontamination and treatment simultaneous
 - (2) Remove clothing
 - (3) Treat life-threatening problems
 - (4) Lavage - water universal decontamination solution
 - (5) Contain/ isolate patient
 - (6) Transport
 - b. Non-critical - unknown/ life-threatening material
 - (1) More contemplative approach
 - (2) Decontamination and treatment simultaneous
 - (3) Remove clothing
 - (4) Treat life-threatening problems
 - (5) Lavage - water universal decontamination solution
 - (6) Contain/ isolate patient
 - (7) Transport
 - c. Non-critical - substance known
 - (1) Slower approach
 - (2) Environmental/ privacy considerations
 - (3) More thorough decontamination
 - (4) Clothing removal
 - (5) Thorough lavage/ wash
 - (6) Drying/ reclothing PRN
 - (7) Medical monitoring
 - (8) Patient isolation PRN
 - (9) Transport
 3. Longer duration event decision making
 - a. Patients in hot zone - non-ambulatory
 - (1) No rescue attempted
 - (2) Wait for hazardous material team
 - (3) Team will set up decontamination corridor
 - b. Team will not make entry until
 - (1) Medical monitoring of entry team
 - (2) Decontamination corridor established
 - c. Longer duration event
 - (1) Often 60 minutes for team deployment
 - (2) Set up time
 - d. Better opportunity for thorough decontamination
 - e. Better PPE
 - f. Less chance of secondary contamination
 - g. Better environmental protection
 4. When in doubt - better grossly decontaminated and alive than perfectly decontaminated and dead
 - a. Deal with patient emergencies first
 - b. Have some type of chemical PPE

1. Decontamination and PPE is ideally driven by the substance encountered
 - a. Sometimes unknown

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- f. Typically used by hazardous material team for entry into hot zone
 - 2. Level "B" protection
 - a. Level of protection typically worn by decontamination team
 - (1) Decontamination wears one level below entry
 - b. Usually non-encapsulating protection
 - (1) SCBA worn outside suit
 - (2) Easier entry and SCBA bottle changes
 - c. Much easier to work in
 - d. High degree of repellence
 - 3. Level "C" protection
 - a. Non-permeable clothing
 - b. Eye and hand protection
 - c. Foot covering
 - d. Used during transport of patients with potential of secondary contamination
 - 4. Level "D" protection
 - a. Firefighter turnout clothing
 - B. Determining appropriate PPE
 - 1. Ideally the chemical is known
 - 2. A permeability chart is consulted to determine "breakthrough" time
 - 3. Double or triple gloves are used or chemical resistant gloves
 - 4. Nitrile gloves have a high resistance to chemicals
 - 5. If situation is emergent
 - a. Take maximal barrier precautions
 - b. Full turnouts or Tvek suit/ gowns
 - c. Use HEPA filters and eye protection
 - d. Double or triple glove
 - e. Remove leather shoes, use rubber boots
 - 6. Ideally at least level "B" protection should be used
 - 7. Ideally use disposable protection
 - C. Transportation of semi-decontaminated patients
 - 1. Use as much disposable equipment as possible
 - a. Reduces decontamination later
 - 2. Practicality of lining an ambulance interior with plastic
 - a. Impractical
 - b. Time consuming
 - c. If airborne contaminants can permeate cabinets it is unsafe for the driver to operate the ambulance
 - d. Better to isolate the patient
 - 3. Patient isolation
 - a. Stretcher decontamination pool
 - b. Continue decontamination and contain run-off
 - c. Plastic can be used to cover pool
 - d. Fits on stretcher
 - 4. Transport to facilities predetermined to handle hazardous materials

- A. Entry team/ decontamination team readiness prior to entry
 1. Assessment of vital signs and documentation
 2. Team members should have normal values on file
 3. Documentation flow sheet must be started

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- a. Blood pressure
 - b. Pulse
 - c. Respiratory rate
 - d. Temperature
 - e. Body weight
 - f. ECG
 - g. Mental/ neurologic status
- 4. Rescuer PPE can cause considerable heat stress
- 5. Prehydration prior to entry
 - a. 8-16 ounces of water or sport drink

B. After exit personnel should return to the medical sector for "rehab"

- 1. Re-assessment of vital signs and documentation
- 2. Documentation flow sheet must be started
 - a. Blood pressure
 - b. Pulse
 - c. Respiratory rate
 - d. Temperature
 - e. Body weight
 - f. ECG
 - g. Mental/ neurologic status
- 3. Re-hydration at exit
 - a. 8-16 ounces of water or sport drink
- 4. Use weight to estimate fluid losses
 - a. Medical control/ protocol determination
 - (1) PO fluids
 - (2) IV Fluids
- 5. No re-entry until
 - a. Vitals back to normal
 - (1) Non-tachycardic
 - (2) Alert
 - (3) Normotensive
 - (4) Body weight within percentage of normal

C. Heat stress factors

- 1. Prehydration of member
- 2. Degree of physical fitness
- 3. Ambient air temperature
- 4. Degree of activity and duration
- 5. Rescue PPE
 - a. Suits protect but prevent cooling
 - b. There is no way to lose heat by
 - (1) Evaporation
 - (2) Conduction
 - (3) Convection
 - (4) Radiation
 - c. Like being in a sauna

- A. Donning and doffing level B and C PPE
- B. Set up a rapid 2 step decontamination process
- C. Set up 8 step decontamination process

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- D. Give a simulated chemical determine PPE and decontamination methods
- E. Pre-entry medical monitoring and documentation
- F. Exit medical monitoring and documentation
- G. Preparing a patient and ambulance for transport